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ABSTRACT TITLE: Piezoelectrically Actuated Miniature Peristaltic Pump

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PRESENTATION - Oral Presentation

ABSTRACT TEXT

There is a range of NASA experiments, instruments and applications where miniature pumps are needed. To address such needs, a piezoelectrically actuated miniature pump is being developed. This pump employs a novel volume displacing mechanism using flexural traveling waves that acts peristaltically and eliminates the need for valves or physically moving parts. This pump is being developed for planetary instruments and space applications. Finite element model was developed using ANSYS for the purpose of prediction of the resonance frequency of the vibrating mode for the piezo-pump driving stator. The model allows determining simultaneously the mode shapes that are associated with the various resonance frequencies. This capability is essential for designing the pump size and geometry. To predict and optimize the pump efficiency that is determined by the volume of pumping chambers the model was modified to perform harmonic analysis. Current capability allows the determination of the effect of such design parameters as pump geometry, construction materials and operating modes on the volume of the chambers that are formed between the peaks and valleys of the waves. Experiments were made using a breadboard of the pump and showed water-pumping rate of about 1.8 cc/min. The pump is continually being modified to enhance the performance and efficiency.

KEYWORDS: Piezoelectrics, Piezopump, Ultrasonics, Actuators, Electroactive

BRIEF BIOGRAPHY: Dr. Yoseph Bar-Cohen is a physicist with over 28 years experience in NDE, sensors, actuators and electroactive materials. He is the Jet Propulsion Lab (JPL) Resident NDE expert and the Group Leader for the NDE& Advanced Actuators (NDEAA) Technologies. Also, he is an Adjunct Professor at the Department of the Mechanical and Aerospace Engineering, the University of California, Los Angeles (UCLA), a Fellow of the American Society for NDT (ASNT) and Chair of the ASNT's Ultrasonic Committee. Dr. Bar-Cohen is leading a NASA task to develop applications for EAP materials. Some of his contributions include his discoveries the leaky Lamb waves and the polar backscattering in composite materials and co-pioneered their applications to NDE. He is the author of more than 170 publications, made numerous presentations at national and international symposia and holds many patents.